Laser Classification Systems

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This installment of *Laser Safety* focuses on the laser classification system. The nomenclature has changed recently and some issues are somewhat confusing. Therefore, I will try to simplify the classification system and highlight what is important.

Class 1 lasers are considered incapable of producing damage and are exempt from any control measures or other forms of surveillance. Class 1M lasers are safe during normal operation, but can be dangerous if viewed with an optical instrument, such as an eye loupe or a telescope. All former Class 1 lasers are now either Class 1 or Class 1M lasers. A laser safety officer (LSO) is not required to operate a Class 1 or Class 1M laser. An example of this type of laser is a laser printer.

Class 2 lasers emit radiation in the visible spectrum (400–700nm) and eye protection is afforded by the aversion response, which is usually 0.25 seconds. The previous classification system consisted of Class 2 and Class 2a lasers, but now this class is called Class 2 and Class 2M (the latter being potentially dangerous if viewed with certain optical aids). An LSO is not required for Class 2, but may be required for Class 2M lasers depending on the application.

Class 3 is divided into 3R (the R stands for reduced requirements) and 3B. For 3R lasers, training and medical surveillance are not required nor is a LSO. However, 3B lasers can cause hazards under direct and specular reflection. Training and a LSO are required when operating these types of lasers.

Most of the lasers dermatologists use are Class 4, which can produce the most serious hazards. In fact, direct beams from Class 4 lasers are a hazard to the eyes or skin and may pose a diffuse reflection or fire hazard. Class 4 lasers may also produce laser-generated air contaminants and hazardous plasma radiation.

In the Canadian province of Ontario where I practice, I know of no regulations that restrict the use of any Class 4 lasers. They are being used by lay people with no training or background in medicine. They are being operated out of basements, spas, and malls. Occasionally, if someone is injured by a laser, or the media is contacted regarding a laser injury, there is a brief hue and cry, but so far, nothing has been done. The Canadian Medical Association has recently questioned the wisdom of the use of these lasers by anyone as unwise, but I have heard of no organized movement to restrict their sale or use.

In Canada, many of the health providers (e.g., dentists, doctors, nurses, and chiropracters) are governed by the Regulated Health Professions Act. This act states that energy cannot be delivered below the dermis without the act being delegated by a physician. This means that this controlled act can only be delegated if the physician has a professional relation with the patient and that physician is capable of performing the act that he or she is delegating and that physician is certain that the person performing the act is adequately trained.

In my opinion, this is the one aspect of the regulation that could bring some sense and control to the widespread and inappropriate use of medical lasers, presuming of course that you agree that these lasers deliver energy below the dermis.

The parameters that combine to determine maximum permitted exposure (MPE) to the eye are quite complicated. They include wavelength, exposure from point sources (less than or equal to 1.5 mradians [a radian is a unit of angular measure and equals approximately 57 degrees]),

extended sources (greater than 1.5 mradians), exposure duration, and single or multiple pulse exposures. Exposures should be less than the MPE.

MPE for the skin is not well discussed in the literature, but the parameters also include wavelength and exposure duration.

This brings us to the concept of the nominal hazard zone (NHZ). This is the space within which the level of the direct, reflected, or scattered radiation during normal operation exceeds the applicable MPE. In other words, how far away from the laser beam aperture do people have to be in order to not be affected adversely in the eyes by the laser beam if they are not protected during a direct hit? Once again, the answer varies according to laser wavelength, pulse duration, and other factors, but the bottom line is that it is quite far—more than a football field away—for most of the lasers used by dermatologists. This would mean that when Class 4 lasers are being demonstrated in front of a group, anyone within the confines of an auditorium watching a live demonstration should be wearing eye protection. Unfortunately, I have been present on several occasions where this precaution has not been followed and the potential consequences could be considerable. This is why I have chosen to help educate physicians on this important topic.

Stay tuned for the next installment of *Laser Safety*, where I will discuss laser-generated airborne contaminants in more detail.

My hope for this new Special Section is that the topics I cover generate interest and feedback. I welcome responses and comments regarding this article and all future articles published in this Special Section. ●

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